

Missouri Resources

Winter 2015 • Volume 32 • Number 1



Missouri Department of Natural Resources

director's comment

Life is a journey with problems to solve and lessons to learn. When we are faced with these challenges along the way, we can react one of two ways – give up out of frustration or persevere and realize they are only temporary setbacks. How we choose to react and the decisions we make will determine the outcome of our journey.

Forty years ago, the Missouri Department of Natural Resources began its journey of protecting our natural resources. Many of our stakeholders, regulated entities and citizens of Missouri have walked alongside our agency. Together, we tackled many of the challenges faced during the last four decades. Our determination and commitment to protecting our natural and cultural resources has brought us to where we are today.

Last month, the department hosted the Governor's Conference on Natural Resources to explore our legacy and celebrate our achievements. The conference also provided us with the opportunity to pause from this journey, check the map, reorient ourselves, if you will, and determine how we must chart our future.



Attendees identified and discussed numerous topics during the conference, as well as suggested and prioritized future actions. The input provided during the conference will be included as part of the department's strategic planning process. This plan will help ensure the department is capturing what the public believes needs to be addressed during the next 10, 20 and 40 years.

Gov. Nixon was the keynote speaker during the evening banquet, and presented the Governor's Natural Resources Awards of Excellence to eight organizations, businesses and individuals who are leading the way in the protection and enhancement of our natural resources. You can read more about these amazing award winners in the DNR News section of this issue of Missouri Resources. Additional information and video from the conference are available at dnr.mo.gov/governor-conference.htm.

As the department's 40th anniversary draws to a close, I'd like to extend our appreciation for your continued support in our journey and pursuit to enhance Missouri's natural resources. We all share a common goal of protecting these most precious natural and cultural resources – because they belong to all of us.

With your help, the department will continue to work to provide all Missourians a healthy environment in which to live, work and enjoy the great outdoors!



Sara Parker Pauley
Missouri Department of Natural Resources

Missouri Resources

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Mission Statement

The mission of the Missouri Department of Natural Resources is to protect our air, land and water; to preserve our unique natural and historic places; and to provide recreational and learning opportunities for everyone.

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MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

40
years
Missouri Department of Natural Resources



2 dnr40 Photo Contest Winners

The photos are in and the votes are tallied. The top four are featured from our contest categories: Natural Resources, People and the Environment, and Special Places.

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by Larry Archer

Not all sinkholes are created equal. One Greene County sinkhole turned out to be a catastrophe-in-waiting.

10 Missouri is a Hot Spot for Cold Weather Birding

by Tom Uhlenbrock

Converging flyways make Missouri ground zero for bird-watchers. Both the Mississippi and Missouri rivers serve as conduits that provide a steady influx of migrating waterfowl and other birds throughout the fall and winter months.

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by Hylan Beydler

The Geosciences Technical Resource Assessment Tool has a long name. The list of things it can do for you is much longer.

departments

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Above: White pelicans begin showing up in mid-September at Riverlands Migratory Bird Sanctuary north of St. Louis. *Photo by Lane Richter/National Audubon Society.*

Front Cover: Late afternoon sun shines through a snow shower on the Grassland Trail in Rock Bridge Memorial State Park, near Columbia. *DNR photo by Scott Myers.*

Back Cover: A Roaring River State Park volunteer pauses with First Day hikers on Jan. 1, 2014. *DNR photo by Kerry Hays.*

dnr40 Photo Contest Winners

And the winners are ...

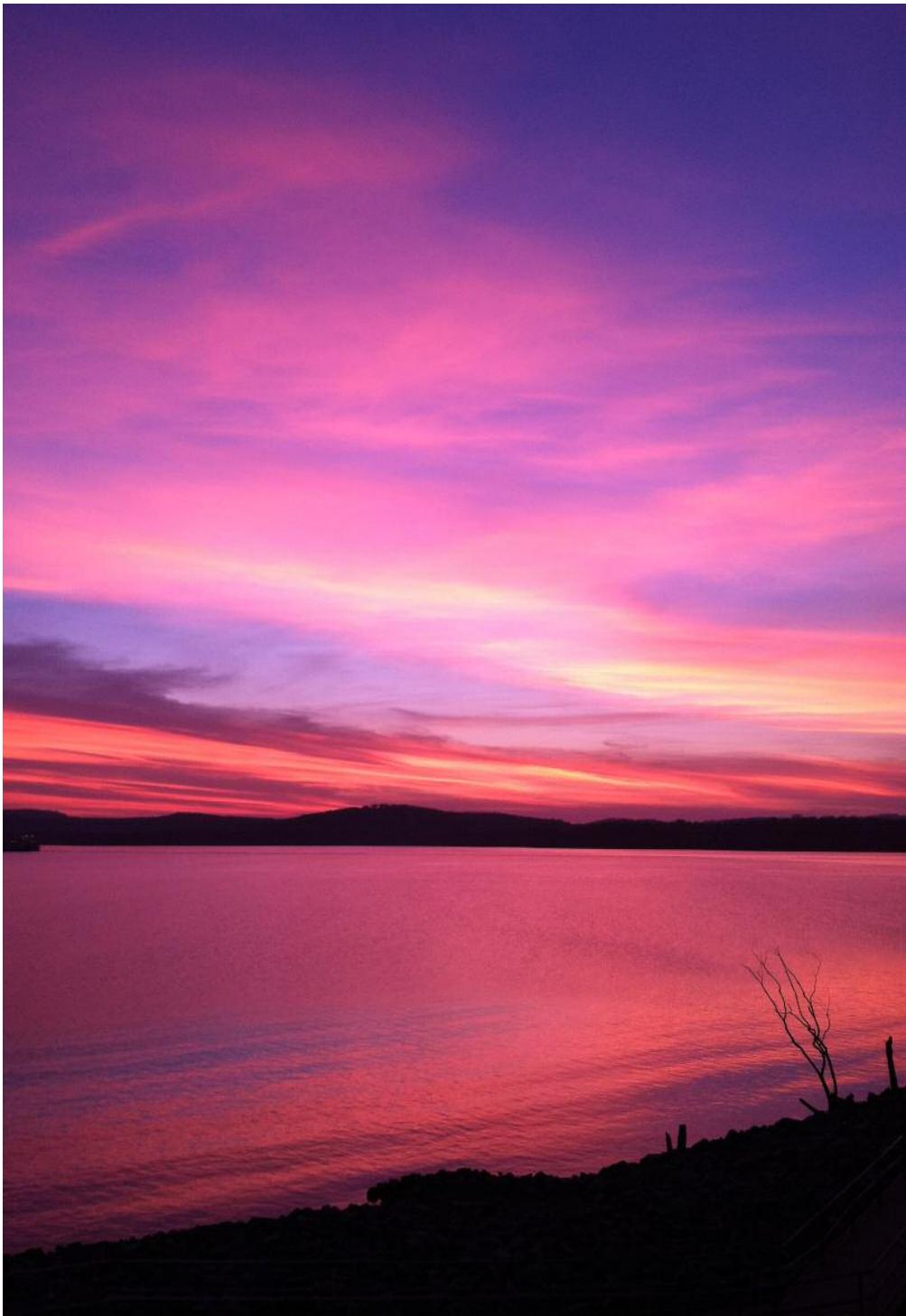
The Missouri Department of Natural Resources has selected the winners of the Missouri-DNR40 Photo Contest held earlier this year to help celebrate and publicize the department's 40th anniversary.

"I am very pleased with the 237 amazing photographs that were submitted in the department's first photo contest," said Sara Parker Pauley, director of the Missouri Department of Natural Resources. "All of the photographs we received truly captured the diversity of Missouri's rich and outstanding natural resources, making the final selections a very difficult decision."

First, second and third places, as well as an honorable mention, were selected from each of the three categories – Natural Resources, People and the Environment, and Special Places.

From the picturesque photograph taken at the peak of sunset on Table Rock Lake, to the young adults exploring and enjoying Elephant Rocks State Park, to the tree-framed image taken of Dillard Mill State Historic Site – we're very proud of Missouri's natural resources and all they have to offer to its citizens and visitors.

These winning photographs capture the reason why it is critically important for the department and Missouri citizens to continue to help enhance our natural resources – after all, it's in our nature!



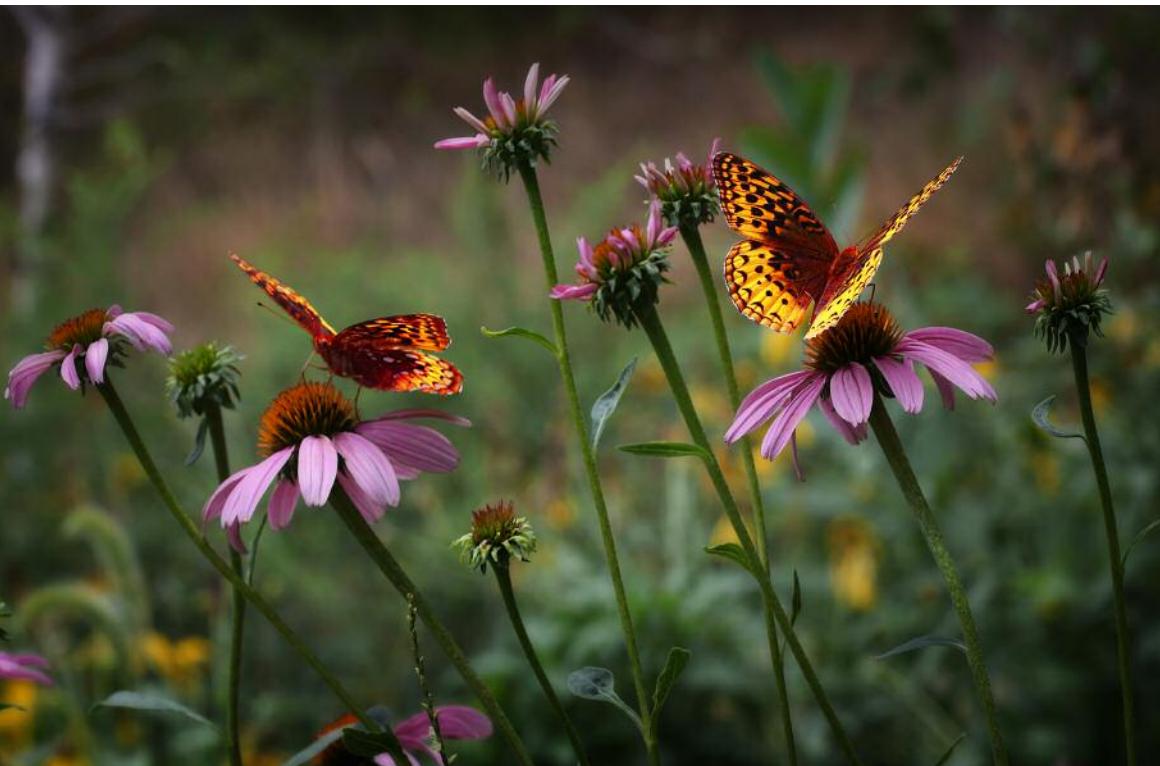
FIRST PLACE David Dean White, Kirbyville

Table Rock Lake Sunset – Table Rock Lake, Taney County

Natural Resources



SECOND PLACE Jerrianne Wallace, Crystal City *Fog over Jefferson County – Frontage Road, Jefferson County*



THIRD PLACE
Jack Eads, Rocheport
Purple Coneflowers and Butterflies – Rocheport

Natural Resources, cont.



SECOND PLACE

Ben Banet, St. Louis

*Staying Warm Beneath Starry Skies –
Taum Sauk Mountain State Park,
Middlebrook
(right)*

HONORABLE MENTION

Joe Herrick, Boonville

*Blue Heron –
Eagle Bluffs Conservation Area,
Boone County*

People and the Environment



FIRST PLACE Ivan Eugene Greer, Columbia *Teamwork at Elephant Rocks – Elephant Rocks State Park, Bellevue*



HONORABLE MENTION

Katie Crum, Dixon

Spring Flower – Maries County (below)



THIRD PLACE

Eric Nichols, O'Fallon

Morning Fishing – Lake Taneycomo, Taney County (left)

Special Places



FIRST PLACE Alex Hanna, Union

Dillard Mill – Dillard Mill State Historic Site, Davisville
(above)



HONORABLE MENTION

Jim Campbell, St. Louis

Sandy Creek Cathedral of Trees –
Sandy Creek Covered Bridge State Historic Site, Goldman



SECOND PLACE

**Jim Campbell,
St. Louis**

*Sandy Creek Bridge
in Winter –
Sandy Creek Covered
Bridge State
Historic Site,
Goldman
(above)*

THIRD PLACE

**Ben Banet,
St. Louis**

*Star Trails Over Proffit
Mountain Campsite –
Taum Sauk Mountain
State Park,
Middlebrook*



THE HOLE STORY

ABANDONED MINE SHAFT TRIGGERS SPRINGFIELD SINKHOLE

by Larry Archer

Mark Hill wasn't too concerned about the crack that appeared in the wall near the second-floor office window in his Springfield home.

"My wife pointed it out to me, and I said, 'Houses settle a bit,'" Hill said. "We had a very big dry spell. It's not a big issue, normally. Everyone gets cracks in a house."

A year later, on a cold January evening in 2013, Hill discovered that the crack he had dismissed as settling was the precursor to something significantly more.

"I guess it was about 9:30ish, and my next-door neighbor, Traci, came over and said, 'I've got something to show you, and it's bad.'"

What he saw was a gaping hole in the ground between the two houses, threatening the foundations of both.

"I walked out to total shock, seeing this huge hole there," he said. "The air conditioning unit was hanging off the pipes; the gas meter was sitting on the gas pipe, doubled over."

The Missouri Department of Natural Resources dispatched environmental engineer Brent Willeford, specialists Mike Mueller and Greg Snellen, and geologist Neal Elfrink to the site to assess the situation.

With its karst topography, southwest Missouri has more than its share of sinkholes, but this was a manmade catastrophe, said Willeford. "Had I shown up on site and not been told it

was mineshaft related I would have thought it was karst," Willeford said.

The Greene County Resource Management Department had determined it was probably an abandoned vertical mine shaft known as "Big Ben," which served lead and zinc mining operations and was likely originally filled in the 1950s or 1960s.

As the original fill material in the shaft settled, a gap formed that eventually made its way to the surface, causing the collapse, Willeford said.

Upon viewing the hole, which measured approximately 31 feet long, 14 feet wide and 15 feet deep, department staff's original concern was that the hole would continue to grow, further endangering both of the homes.

"The integrity of the house was the first thing that jumped out at me," Willeford said. "My first thought was what can we do to stabilize the site to buy us some more time."

Within a day of arriving on the scene, staff arranged for temporary fill material at the site and a series of timbers and jacks to support the homes' foundations. With the homes temporarily supported, staff worked with the engineer hired by the homeowners on a longer-term solution.

A poured-in-place reinforced concrete beam was constructed to support Hill's house, while a series of pilings were used to support his neighbor's home. The process took more than six weeks to complete.

With the homes secured, the department oversaw the proper closing of the shaft, which required approximately 77 cubic yards of reinforced concrete.

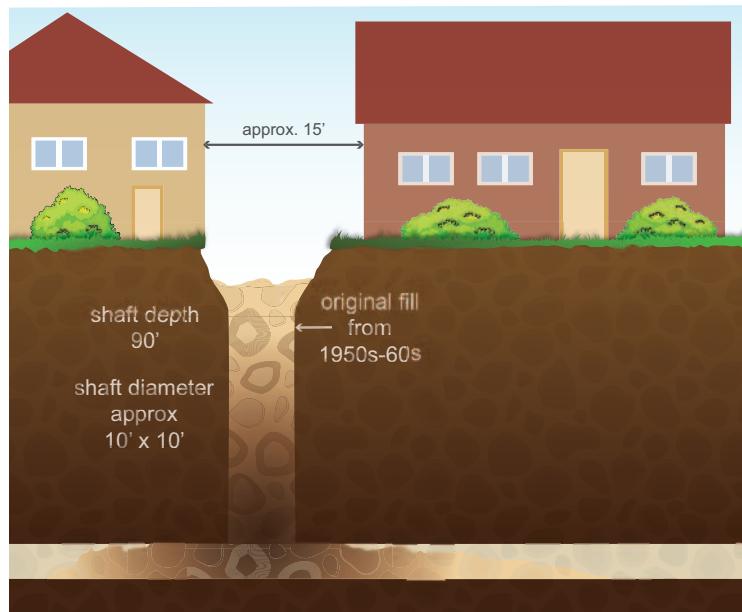
Despite the cost and inconvenience, the homeowners were fortunate, Willeford said.

"Had the houses been 20-30 feet either way, and that hole opened up underneath one of them, it would have been a completely different situation," he said. "The house would have likely had to be demolished."

Homeowners interested in finding out what might be lurking beneath their homes have access to the same materials staff used through the Missouri Geological Survey's GeoSTRAT system (see article on page 14) and the State Archives, a branch of the Missouri Secretary of State's Office.

Now landscaped, the site bears no resemblance to the scene that January evening when "all hell broke loose," Hill said. "The whole team and the

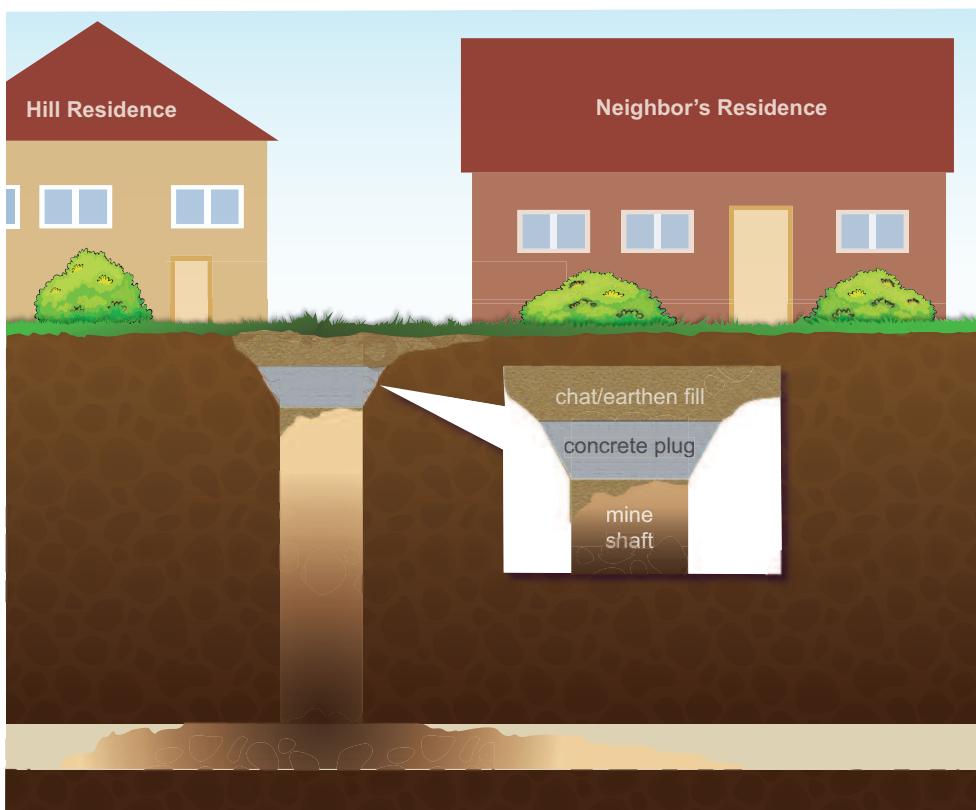
MINE SHAFT COLLAPSE*



*not to scale

After nearly 60 years of settling, gaps began to open up in the original fill material, eventually leading to a collapse of the soil into the opening of the mine shaft (left). After stabilizing the homes' foundations, crews overseen by the Department of Natural Resources' Land Reclamation Program capped the original shaft with a concrete plug, covered the plug with earthen fill and small rock (chat) and replanted the grass that had been there originally (below).

MINE COLLAPSE REPAIR



whole approach was just so good," he said. "From the initial work of getting things out and getting it stabilized, to the engineer who really did his homework on it, to the construction company, and most of all, to the guys from DNR who just did a magnificent job. I

can't speak highly enough of them – they saved my house. And that's an incredible thing."

Larry Archer is the division information officer for the department's Division of Environmental Quality.



Missouri is a Hot Spot for Cold Weather Birding

by Tom Uhlenbrock



Missouri's big rivers serve as a migratory highway for waterfowl. Some of the nation's best bird watching happens within the state with mass gatherings of ducks, geese, pelicans, eagles, trumpeter swans and other species.

Birds heading south for the winter use four major flyways to cross the continent, and Missouri is smack dab in the middle of two of them – the Mississippi Flyway and the Central Flyway. The latter begins in the Arctic, crosses the Great Plains and heads across Missouri, where it meets the Mississippi Flyway at St. Louis.

"The big river systems in our country are very visible landmarks for birds – they can see the rivers day and night," said Lane Richter, a senior ecologist with the National Audubon Society. "Although the landscape has changed over the last 200 years, the rivers still provide valuable habitat for over-wintering purposes," Richter said. "You get different groups of birds that stop to refuel before moving on, and some that stay to spend the winter."

"The nice thing is the Mississippi River runs north and south, and is the most direct route from northern breeding habitat to southern wintering grounds."

Richter has the best seat in the house for watching the massive migration. His office is at the Audubon Center at Riverlands, a new bird-watching facility at the Riverlands Migratory Bird Sanctuary developed by the U.S. Corps of Engineers on the Mississippi River north of St. Louis.

Confluence Point State Park, which is the only place where a visitor can put one foot in the Mississippi and the other in the Missouri, is adjacent to the sanctuary at the meeting of the two great rivers. The state park, federal refuges and the Missouri De-

In 2013, Van Meter State Park, near Marshall, is almost completely obscured by thousands of snow geese that arrived at Grand Pass Conservation Area wetlands. DNR photo by Scott Myers

“... last winter, I counted 26 species right outside the center window.”

- Lane Richter, ecologist, National Audubon Society



After the ice begins to form on smaller impoundments, bald eagles often congregate near lakes and rivers with open pools or spring-fed waters, such as this adult at Roaring River State Park near Cassville.

DNR photo by Kerry Hays

Majestic trumpeter swans are welcome winter visitors at Edward “Ted” and Pat Jones-Confluence Point State Park.

DNR photo by Scott Myers

partment of Conservation’s Columbia Bottom Conservation Area join to create a 10,000-acre welcome mat for migrating birds that follow the freeze line south in search of open water.

“One period last winter, I counted 26 species right outside the center window,” Richter said. “You’d find a new species as fast as you could write them down.”

Among the arrivals were as many as 60 bald eagles, flocks of 50 or more white pelicans and more than 900 trumpeter swans, a regal bird with a wing span of up to 8 feet.

“That was double the high count for trumpeters from the year before, probably because it was a harsh winter up north,” Richter said. “The trumpeters are the new all-stars out there – they’re a nice story.”

Confluence Point State Park provides a complement to the large open water bays of

the sanctuary because it has a dozen shallow pools that attract other species of birds.

“The sanctuary gets more ducks and geese and we get the wading birds,” said Quinn Kelner, natural resource manager of the park. “We get egrets and herons, yellow rail, phalarope, plovers and other waders.

“We get a few short-eared owls, and always have groups of horned larks that feed on the shoulders of the roadway.”

Wintering bald eagles can be found at any of the state parks that have large lakes or are along rivers. During the 2013 annual winter eagle count, 2,693 eagles were recorded in the state. The three popular state trout parks – Montauk, Bennett Spring and Roaring River – attract eagles that dine on trout in the spring-fed streams.

Here are other excellent winter bird-watching spots in Missouri State Parks, including some that team with federal facilities and conservation areas to attract massive numbers of birds. National wildlife refuges and state conservation areas allow hunting; state parks do not.

Wakonda State Park: Tucked in the northeast corner of the state along the Mississippi River, Wakonda State Park has six lakes that serve as pit stops for birds migrating down the big river.

“The teal will start arriving at the end of August, followed by cormorants, pelicans, geese, trumpeters and every duck you can name,” said Kyle Scott, park manager. “We had more than 100 trumpeters for a while last year. A few eagles will stop by and will

stay when everything else freezes up because the geese keep pools of water open."

Pershing State Park: Located in north-central Missouri on Locust Creek, the park has created a wetlands area on 1,500 acres of land that has been sculpted into a mosaic of pools.

"I'm guessing on a good day, we'll get 150 bald eagles," said Tom Woodward, park manager. The park is part of the Golden Triangle, which includes the neighboring Fountain Grove Conservation Area and Swan Lake National Wildlife Refuge. Together, they hold nearly 25,000 acres of wildlife habitat that is a magnet for waterfowl.

Van Meter State Park: South of the Missouri River near Marshall, the park features the 300-acre Oumessourit Natural Area, which shows what the floodplain looked like before the river was channelized and constricted by levees. Three short boardwalks lead out into the marsh, wet prairie and forest. An active bald eagle nest is nearby. Walk out onto the boardwalks in fall and winter, and the skies above are lined with the V-formations of waterfowl flying in and out of the nearby Grand Pass Conservation Area, which is 5,300 acres of wetlands along six miles of the river. The distant honking of the geese is mesmerizing.

Lewis and Clark State Park:

Located north of Kansas City along the Missouri River, the park is named for the explorers who stopped there in 1804 and named the big oxbow lake Gosling Lake for the huge numbers of geese. The lake is still there and in winter attracts large numbers of waterfowl, many of them flying in from the nearby Squaw Creek National Wildlife Refuge.

"In winter, we are like a mecca for eagles, last year it was well over 100," said Jim Kunce, park manager. "We get thousands of snow geese and Canada geese. We have a really cool observation area on a paved plaza that sits beside the lake."

Big Lake State Park: West of Squaw Creek National Wildlife Refuge on the Missouri River, the park has hundreds of eagles

that visit during the winter and five resident eagles that live year-round in the park. The park features one of the state's most dramatic displays of nature, with snow geese rising like a noisy white tornado at daybreak, and eagles moving in to feed on those that didn't make it through the night.

"We probably had 300,000 snow geese last year because of low water in the refuge, and more than 150 bald eagles, which follow the snow goose migration," said Russell Burge, park manager. "They stayed here for two weeks. The majority of the lake was frozen, but they were able to keep a big hole open. Birdwatchers make the loop through the wildlife refuge then come here and drive the three-mile park road."

Lane Richter, the Audubon ecologist at Riverlands, said the wildlife show generally starts in September and continues through the winter season until the warm-up of March sends the birds back north.



DNR photo by Russel Burge

"We get a lot of school groups that come out and visit; most have only seen the Mississippi River from the Arch grounds," Richter said. "They go out to Confluence State Park to witness the power of the rivers, and along the way see all the birds in their natural habitat. It's a real eye-opening experience." 

Canada geese and trumpeter swans share ice and open water at Big Lake State Park in Holt County.

Tom Uhlenbrock is a writer for Missouri State Parks.



GeoSTRAT – Tried and True

by Hylan Beydler

While examining property near his family home, Lucas Tabor, a student at Missouri State University-West Plains, views the Certified Wells layer in GeoSTRAT to determine locations of existing and closed wells.

DNR photo by Scott Myers

If you haven't used GeoSTRAT, the Department of Natural Resources' Geosciences Technical Resource Assessment Tool, you ought to give it a try.

GeoSTRAT is a Web-based tool, built using Google Earth and ESRI GIS mapping technology. It makes satellite imagery and geologic and hydrologic data available to citizens, planners, industry, academia and others online 24/7.

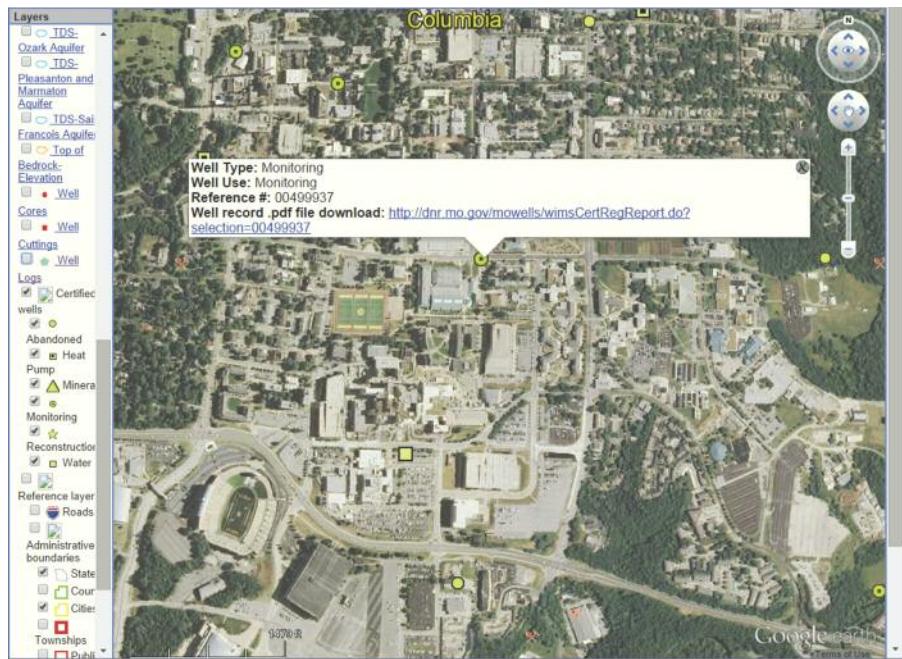
Sinkholes, mines, springs, certified water wells, groundwater depth, cave density and other features can be located on the interactive map using a Web browser. GeoSTRAT can be used for data assessments in disciplines such as hazards assessment, environmental consulting and engineering, local

and regional planning, insurance assessment and others.

GeoSTRAT lets you fly anywhere in Missouri to see aerial views of the landscape and navigate and explore the surface as if you are standing on the ground. Having data at one's fingertips, instead of stored on shelves, in cabinets and only available during conventional workday hours, provides users critical information around the clock. It is invaluable to emergency personnel when natural or man-made disasters occur. Numerous data layers now compiled in GeoSTRAT were used to aid planners in properly locating sites for landfills for debris removal following the tornado that devastated Joplin in 2011. Having



Blackstone Environmental photo



immediate access to abandoned mine and sinkhole locations that could collapse and result in groundwater contamination will be extremely beneficial in similar instances.

During development, testers provided feedback about the product.

Tony M. Schroer, Barr Engineering, Jefferson City, and Kenny Hemmen, Geotechnology Inc., Overland Park, Kan., both indicated GeoSTRAT would benefit them and their colleagues.

"I'm really impressed. GeoSTRAT is the best I've seen from any state," said Nancy Dickens, TetraTech, St. Louis.

Lindsay James, a registered geologist, is a project manager with Blackstone Environmental, based in St. Louis, Mo. A regular

user of GeoSTRAT, James has been involved in a wide variety of environmental projects in Missouri, with particular emphasis on hydrogeological site characterization and contamination.

Although GeoSTRAT is a relatively new product, it already has aided James in conducting risk-based corrective action site investigations, geological mapping, groundwater monitoring, source evaluation, nature and extent investigations, environmental site assessments, feasibility studies and the design of groundwater monitoring networks. James explained how GeoSTRAT benefits both Blackstone and the company's clients:

(Top) Core samples of the Winterset Limestone drilled at a Blackstone Environmental project site in western Missouri.

(Above) This GeoSTRAT screen shot of an area in Columbia shows the Wells and Mines layer, with information about a well owned and operated by the University of Missouri-Columbia.

GeoSTRAT: A Tool for Everyone

GeoSTRAT is easy to use. If you're a history buff, educator or just curious about your surroundings, you will find something interesting using the tool. I discovered information about a limestone surface mine located west of Dixon my late granddad Joe Beydler owned and operated as a young man. He was one of many who helped build our interstate highway system.

As it happened, the first layer I chose was "Inventory of Mines, Occurrences and Prospects." This layer provides information about the commodity, operation status and type, formation mined or prospected, elevation, operator name, and more.

Being a native of Dixon, I continued to explore that region. Next, I turned on the Well Logs layer and located Community Public

Well #1, owned and operated by the city of Dixon. The well was drilled in 1939 at a depth of 886 feet; depth to bedrock was 20 feet; static water level after it was cased was 180 feet; and the elevation at the location is 1,162 feet above sea level.

A wealth of information is available using GeoSTRAT. You may discover things related to geology and your family history, or other helpful information. Explore GeoSTRAT and let us know what you discover. Send questions and suggestions to geology@dnr.mo.gov.



DNR photo by Scott Myers

(Above) Mary Ann Mutrux assists Karley Good and Shaylee Conner in identifying watersheds, bedrock, springs and other features. Mutrux, geography instructor with Missouri State University-West Plains, developed a project called "Geosystem Personal Profile." Her students use GeoSTRAT to complete the project work.



Dorothy Beydler photo

(Above right) This lime spreader was used in the 1940s and 1950s at the limestone mine owned by the story author's late grandfather. Pictured as a young boy, standing on the truck's sideboard is her father, Bill. Mines and other features are found in GeoSTRAT.

"GeoSTRAT has proven invaluable in a wide variety of projects for us, everything from environmental site assessments, to accurately costing drilling services, to conducting even more complex hydrogeological site investigations."

Blackstone Environmental recently employed the GeoSTRAT tool on a bedrock coring project that was part of a larger hydrogeological site characterization.

"We were able to use the overburden thickness (soil or other unconsolidated ma-

terial layered over bedrock) layer information and lithologic (physical characteristics of rock) information from nearby well logs to provide more accurate subsurface information to our drilling subcontractor," said James. "This enabled us to more efficiently plan drilling work and to provide more realistic drilling cost estimates to our client."

The ability to overlay existing data on an aerial image from Google Earth was helpful in determining locations for ad-



DNR photo by Scott Myers

ditional borings and wells. Blackstone used lithologic information from GeoSTRAT, along with field data to create geologic cross sections of the project site. James said having that information readily available helped streamline the project from its initial budgeting stage to preparing the job's final report.

"Without GeoSTRAT, we likely would have incurred additional expense to extract rock core and to characterize the rock," James added.

Blackstone also uses GeoSTRAT when conducting Phase I Environmental Site Assessments, which are often used to assess environmental conditions of real estate as part of property transactions. The Certified Well layer is a great screening tool for site assessments because the existence of monitoring wells on or near a property can indicate the current or past presence of contamination. Conversely, if a monitoring well is discovered during site reconnaissance, information from the Certified Well layer can provide ownership information and well construction details.

Because Phase I Environmental Site Assessment reports often are needed quickly, knowing details such as the well identification and ownership can help us obtain background documents more quickly.

"The Bedrock layer is also an excellent resource for general geological information for the area that is typically provided as part of a Phase I Environmental Site Assessment," said James.

The department adds new and updated data regularly that can be downloaded and used in free and commercial mapping software. Learn more and access GeoSTRAT at dnr.mo.gov/geostrat.



(Above) To begin her research, Mandi Follis identified the Galloway City Park boundary using GeoSTRAT. **(Below)** Students Jeff Bates and Jessi Thomason use the software to identify geologic, hydrologic and man-made features.

Hylan Beydler is division information officer for the department's Missouri Geological Survey.



DNR photo by Scott Myers



A Tranquil Time to Fish for Trout

by Tom Uhlenbrock



DNR photo by Kerry Hays

(Top) A solitary fisherman stalks a pool that normally is crowded during the regular trout-fishing season. DNR photo by Tom Uhlenbrock
(Above) Snowfall paints a wintry scene for catch-and-release anglers to enjoy at Montauk State Park.

The crowds are gone, wildlife abounds and the fish are biting. The catch-and-release season is a beautiful time to visit Missouri State Parks' three popular trout fishing parks.

March 1 marks the traditional opening of the trout season, and is a festive occasion with anglers lining the water to try their luck.

Montauk State Park near Salem, Bennett Spring State Park near Lebanon and Roaring River State Park near Cassville all will sell as many as 2,000 trout tags in what has become an annual rite of spring for generations of anglers, families and friends alike.

The regular season closes at the end of October, and a magical thing happens at the parks. Each are located in deep wooded Ozark valleys cut by clear, spring-fed streams, and a peaceful tranquility settles over the pristine landscape.

The catch-and-release season opens the second Friday in November and goes until the second Monday in February. Trout fishing is allowed on Fridays, Saturdays, Sundays and Mondays.

The trout are hungry, and there are fewer fishermen to catch them. For a novice, it's a good time to work on your fly-fishing skills without the elbow-to-elbow competition.

Deer and wild turkey roam the woods, otter and beaver work the river banks and the shrill cries of bald eagles break the silence. A pair of bald eagles has nested at Montauk for more than a decade. They are not shy about making their presence known.

"It's just a nicer time of the year," said J.D. Muschany, superintendent at Bennett Spring. "There's less fishing pressure. The water is usually very clear. You can see all the animals, the deer walking around. It's a good time to be in the park."

At Roaring River, campground 1 remains open during winter and the Department of Conservation sells fishing licenses and trout permits (\$7) at the hatchery office. The park lodge, restaurant and store are closed.

Bennett Spring keeps a campground open with a shower house. Four duplexes, with two bedrooms and a kitchen in eight units, also are available during catch-and-release. The store is open on Friday, Saturday and Sunday.

Montauk keeps its motel and several cabins open throughout the winter season. The campground also is open seven days a week, but the shower house is closed. The store and restaurant in the lodge are open on Friday, Saturday and Sunday.

Charles and Cindy Maledy live near Montauk and often visit the park to fish during the catch-and-release season. On a warm Sunday afternoon, following an overnight snowfall, the two had the Current River headwaters to themselves.

"Winter is just like the regular season," Charles Maledy said. "Sometimes you catch fish, sometimes you get skunked."

"But there's nobody right beside you," said his wife. "Out here, you can look downriver and not see another person."

With the leaves off the trees and the light snow covering the landscape, spotting wildlife was easy. Rick Shults, an amateur photographer, brought a camera rather than a fishing rod to the park.

"I got some good eagle shots this morning," said Shults, who also photographed a family of otters that lives at Montauk Lake.

Steve Bost, the naturalist at Montauk,

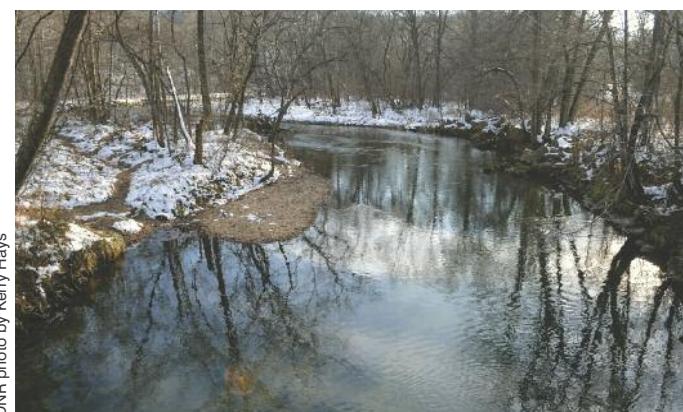
said winter is his favorite time to be in the park, especially after a snowfall.

"It looks like a Christmas postcard," Bost said. "It's peaceful, relaxing. You can feel your blood pressure drop as you drive into the valley. It's hard to put a price on something like that."

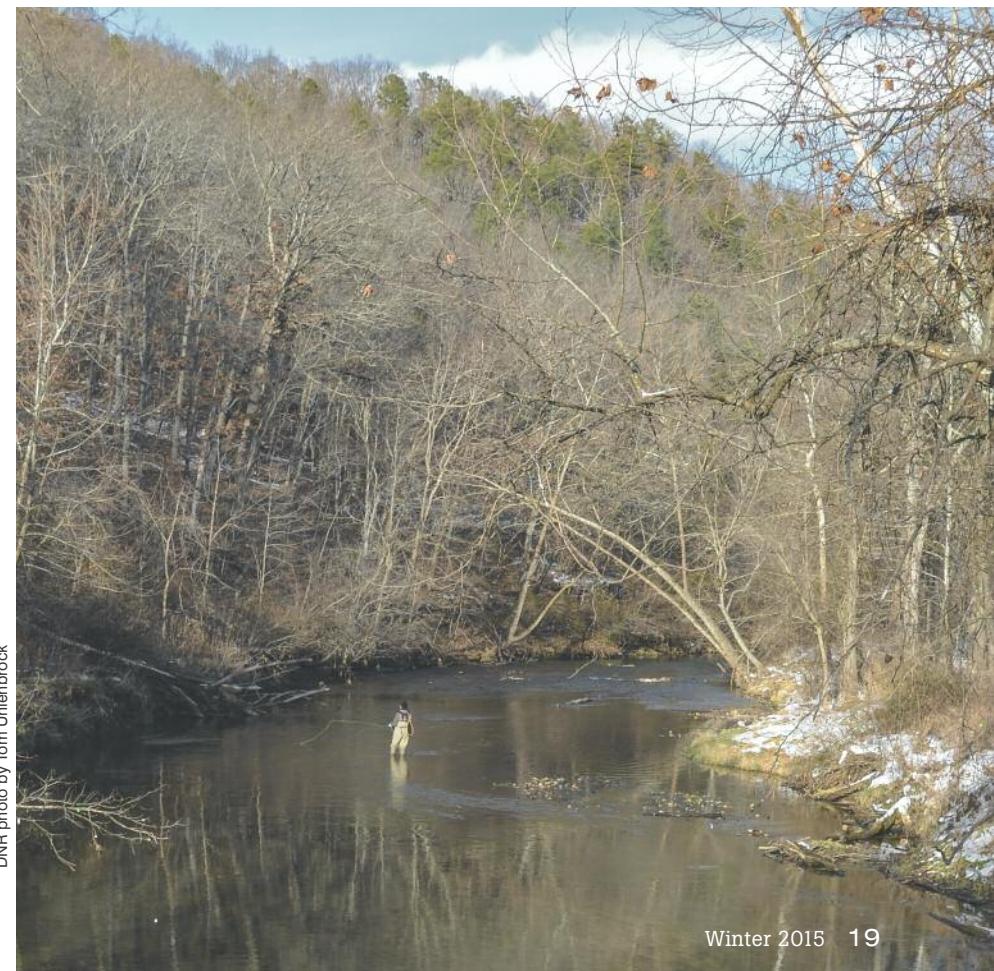
Tom Uhlenbrock is a writer for Missouri State Parks.

(Bottom) An angler fishes the Current River headwaters at Montauk State Park during the catch-and-release season.

(Below) Fewer anglers means more hungry trout during winter fishing at Roaring River State Park.



DNR photo by Kerry Hays



DNR photo by Tom Uhlenbrock

Governor's Natural Resources Awards of Excellence Winners

Gov. Jay Nixon and DNR Director Sara Parker Pauley presented awards of excellence during the Governor's Conference on Natural Resources recognizing outstanding innovations and contributions in managing and protecting our state's natural resources.



Mid-America Regional Council provides a venue for collaboration among local, state, federal, nonprofit and community leaders to collectively identify environmental protection strategies that also contribute to community and economic development.

Green Circle Projects actively engages in promoting sustainable development in Springfield through its work with Farmers Park and the Trail

Spring/Two Rivers Bike Park projects.

Missouri American Water adopted a special responsibility for river stewardship and partnered with several organizations to raise awareness and preserve the Missouri River.

Missouri State University officials are committed to using education and community outreach to provide students with the knowledge and skills they need to be environmentally responsible and to consider the global ramifications of their actions.

Harrison Creek Farm LLC, owned and operated by the Brinker family, manages a farm – a state-of-the-art facility designed to conserve the land for future generations.

Watershed Committee of the Ozarks sustains and improves the water resources of Springfield and Green County through education and effective watershed management.

Vannessa Frazier was presented

with the Natural Resources Champion award for her more than 35 years of dedicated service to Missouri Bootheel residents. Her qualifications, determination and dedication to her community and our natural resources are truly emblematic of a natural resources champion.

Winter Shower Houses Available in Four State Parks Campgrounds

Campers looking to plan a winter camping adventure in Missouri State Parks will be able to enjoy an extended shower house season. All 40 state parks and historic sites with camping have campsites available year-round, but water and shower are usually only available from April 1 through Oct. 31.

Roaring River State Park will have a shower house available until Jan. 1. At Bennett Spring, Table Rock and Johnson's Shut-Ins state parks, at least

Time Exposures

Edgar Gleim Maclay spent most of his professional life as a civil engineer after graduating from Missouri State University (now the University of Missouri-Columbia) around 1900. He also spent a lot of his free time shooting photographs. Many of his images depict scenes of family, the Maclay home in Tipton, camping trips and ferry rides. Maclay also spent time shooting scenes of the university campus in Columbia, including buildings, dormitory interiors, football games and other events.

The scene in this c. 1898 Maclay photograph, titled, "Grubbing the Raft on Niangua River," shows a man helping to move a seemingly unending wooden raft down river. The raft itself is made of freshly milled railroad ties and the "grubbing" describes the method by which they are being moved out of the woods and down river. Grubbing involved the use of pins (grubs) to fasten together lumber to create a raft. In many instances, the rafts were loaded with additional lumber for transportation purposes.

The Maclay home in Tipton still exists today. Built in 1858 by Wallace and Mariah Williams as a school for girls, the home later was purchased by the Gleim and Maclay families. Located on Route B, just north of Highway 50 in Tipton, the home is open for tours the second and fourth Sundays of every month from May through October. For more information on the Maclay Home, visit tiptonmo.com/Tipton_Chamber_of_Commerce/Maclay.html



Send your photo to "Time Exposures," c/o Missouri Resources, PO Box 176, Jefferson City, MO 65102-0176. Original photos will be returned via insured mail. Pre-1980 environmental and natural resource photos from Missouri will be considered. Please try to include the date and location of the picture, a brief description and any related historic details that may be of interest to our readers.

one shower house is open throughout the year for guests who want to enjoy a camping experience in all seasons. Dates are weather dependent, so guests should remember to check the park website before planning a camping trip. For full details of amenities available at campgrounds in these parks, visit mostateparks.com.

To make a camping reservation, visit mostateparks.com 24 hours a day, or call 877-ICampMo (877-422-6766) 7 a.m.-7 p.m. CST, seven days a week.

February is Earthquake Awareness Month



Each February, Missouri observes Earthquake Awareness Month. Three of the largest earthquakes experienced in the continental United States occurred in the New Madrid Seismic Zone in the winter of 1811-12. The risk of similar earthquakes remains. Earthquakes are a natural hazard that no one can accurately predict. Small earthquakes occur daily in Missouri.

Preparing and planning is essential for earthquake safety and fortunately, there are things everyone can do to be better prepared.

To raise awareness, geologists with the Missouri Department of Natural Resources will partner with local, state and federal agencies and organizations by participating in a number of public activities to provide educational opportunities relating to earthquakes.

Everyone is encouraged to attend public events throughout the month. See an interactive map showing recent earthquakes and learn more at dnr.mo.gov/geology/geosrv/earthquakes.htm.

Water Commissions Hold Joint Meeting

On Oct. 1, the Department of Natural Resources hosted the first-ever joint meeting of the four Missouri

OUR MISSOURI WATERS

Improving Regional Water Supplies in the Lower Grand River Watershed

The need for additional water supply for communities is a primary concern identified in the Lower Grand River Watershed, as part of the Department of Natural Resources' Our Missouri Waters initiative. Many of the public systems in this watershed rely on water from small community lakes and face a lack of water supply during periods of drought.

In April 2014, public water supply operators, water district boards, county commissioners and local town leaders from a 10-county area in north-central Missouri attended a Regional Water Supply Workshop in Milan. Speakers at the workshop discussed plans to provide a safe, reliable water supply to the area. A regional development plan for water transmission lines, including engineering, environmental and legal considerations was discussed. Attendees provided input about a regional water supply transmission network to improve the connectivity of the water systems in the region. There also was an update on the East Locust Creek Reservoir project, a proposed 2,200-acre lake northeast of Milan that would provide drinking water to systems in 10 counties.

Sixty-six people attended the workshop, 44 of those representing public water systems or local government from the area.



Lower Grand River, Livingston County.

DNR photo by Scott Myers



boards and commissions with water-specific responsibilities.

Members of the Clean Water, Safe Drinking Water, Soil and Water Districts commissions, and the Well Installation Board met to discuss common challenges and concerns, and to learn more about the department's strategies for dealing with water-related issues in Missouri.

"Each of these entities has very specific, legislatively dictated responsibilities, which doesn't always allow them to become familiar with the work being completed by the other commissions or the department," said Department of Natural Resources' Director Sara Parker Pauley. "The joint

meeting provided the department with the opportunity to discuss its key functions and planning efforts related to water resources management, and allowed the members to provide input on ways to improve and continue to engage moving forward."

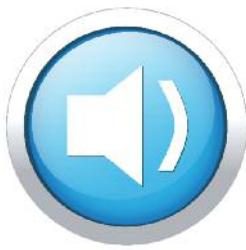
Video of the joint meeting is available online at youtu.be/A0MVubrSxtQ.

For news releases on the Web, visit dnr.mo.gov/newsrel.

For a complete listing of the department's upcoming meetings, hearings and events, visit the department's online calendar at dnr.mo.gov/calendar/search.do.

Looking for a job in natural resources? Go to dnr.mo.gov/hr.

top spots



Top Spots to Take an Audio Tour



(Clockwise from top left) Mastodon State Historic Site in St. Louis is one of two state parks evaluating a new audio tour along one of its trails. DNR photo by Tom Uhlenbrock
At Weston Bend State Park, the first stop on the audio tour is at a barrel-vault root cellar built in the 1830s. DNR photo by Matt Carletti

The audio tour at Weston Bend includes an explanation of the historic corn picker along the trail. DNR photo by Matt Carletti

Brooke Mahar, who wrote the audio script at Mastodon State Historic Site, climbs the stairs along the trail that features the tour. DNR photo by Tom Uhlenbrock

In order to improve guests' experiences in Missouri's state parks and historic sites, audio tours are available. Anyone with a cellphone has a way to take a guided hike on a trail and learn more about the history of the area.

Mastodon State Historic Site and Weston Bend State Park offer audio tours. Guests can take the tours by accessing the OnCell app or by dialing the number listed on signs at each site. Smartphone users also are able to scan the QR code on the signs and bring up photos.

At Mastodon State Historic Site near St. Louis, guests can take an audio tour of the Kimmwick Bone Bed. The site provided the first evidence in North America that humans and mastodons coexisted during the Ice Age – and there is plenty of history to explore.

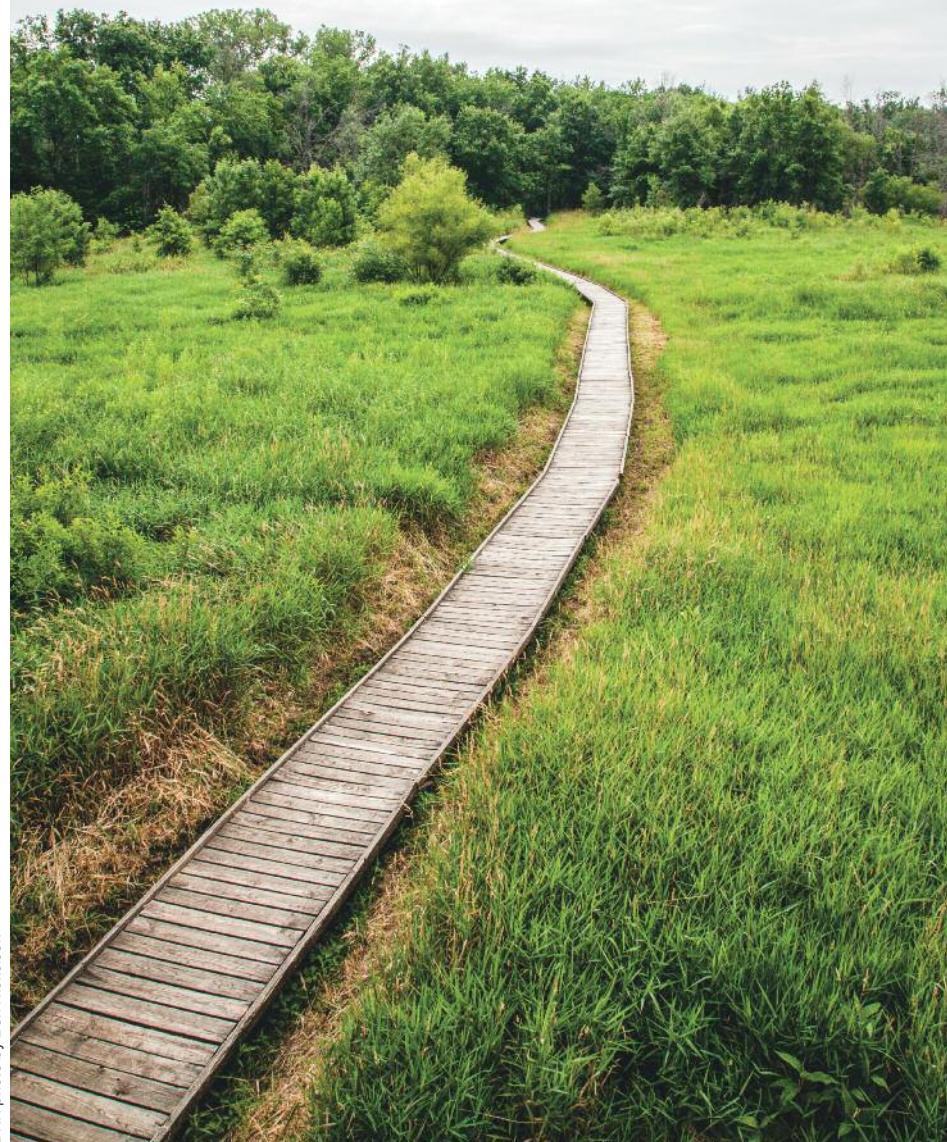
At Weston Bend State Park near Kansas City, guests can follow along an old farm road and learn a lot about the westward American settlers from the 1800s. The tour includes a barrel-vault root cellar, an abandoned corn picker and a rare Missouri River survey marker.

To find out more about audio tours in Missouri State Parks, visit mostateparks.com.

trails highlight

Boardwalk Trail at Pershing State Park

DNR photo by Scott Myers



DNR photo by Ben Nickelson

(Top) The Boardwalk Trail provides a great vantage point to explore the wetlands and view wildlife at Pershing State Park in Linn County.

(Above) The trail winds through a wet prairie near a meandering stream with oxbow sloughs and cutoffs, and into a bottomland forest.

Pershing State Park allows guests the opportunity to wander through a slice of pre-settlement landscape, and the park's accessible Boardwalk Trail offers a great opportunity for everyone to experience the park's diverse landscape.

The best way to explore the wetlands and view wildlife is on this interpretive boardwalk. The exhibits along the boardwalk explain the forces that interact with each other to create and maintain the wetlands and wildlife found in the park. The boardwalk leads visitors through bottomland forest, marsh and wet prairie. An observation tower overlooks the largest remaining wet prairie in north Missouri at nearly 1,000 acres.

The area along the trail has been designated an Important Bird Area by the Audubon Society. Bird-watchers can enjoy a huge variety of birds including great blue herons, barred owls, pileated woodpeckers, migrating songbirds, waterfowl and wintering eagles.

On the prairie, visitors will find cordgrass, compass plant, spiderwort, blue flag iris and the rare pale green orchid. The endangered massasauga rattlesnake can be found along with deer, raccoon, river otter, mink, beaver, muskrat and several species of amphibians. The trail shares a trailhead and a section with the six-mile Locust Creek Riparian Trail.



Missouri State Parks – a division of the
Missouri Department of Natural Resources

Rock Matters



Rhyolite

An igneous, volcanic rock composed chiefly of quartz and feldspar.

Rhyolite formed when lava and volcanic ash erupted from ancient volcanos and cooled very rapidly. It makes up most of the steep, high knobs that form the St. Francois Mountains, in southeast Missouri.

DNR photo by Hylan Beydler

Rhyolite exposed in Missouri is extremely dense and fine-grained. Resistant to weathering, it is a compact, hard, brittle rock. Referred to by stone producers as a "traprock," Missouri rhyolite varies in color from light gray through pink and red to dark purplish-red. Sometimes it has a distinct banded pattern.

The stone is known for its natural beauty, durability and utility. Rhyolite quarried in Missouri was historically used in the manufacture of paving blocks and roofing shingles; for high-quality construction aggregate; as road metal (crushed rock used to construct a road); and for other purposes.

Today, rhyolite continues to be a very important resource for the state's transportation infrastructure and construction industries as it is used as a road metal, a high-quality construction aggregate, and for making granules for roofing shingles.

Rhyolite is a core feature in some of Missouri's most spectacular scenery and popular state parks, including Johnson's Shut-Ins State Park and Taum Sauk Mountain State Park. Each of these parks owes its unique character to the igneous rocks and to the geologic processes that have formed and shaped them.

The St. Francois Mountains provide a rare glimpse into rocks formed by the most violent type of volcanic eruptions known on the earth. Consequently, geologists come from around the world to study them, and

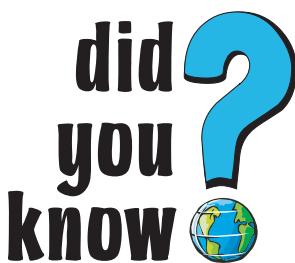
visitors take in all the area has to offer, including climbing to the top of Taum Sauk Mountain to be on top of Missouri – literally. Taum Sauk Mountain, in Taum Sauk Mountain State Park, rises to 1,772 feet above sea level – the highest point in the state.

The park's 7,500 acres also includes Mina Sauk Falls, the state's tallest waterfall. The moderately rugged Mina Sauk Falls loop trail takes visitors to Mina Sauk Falls, which drops 132 feet down a series of rocky rhyolite ledges into a clear, rock-bottom pool that sits at the base.

Devil's Tollgate lies one mile below the falls along the Taum Sauk Section of the Ozark Trail. This eight-foot-wide passage takes visitors through 50 feet of rhyolite standing 30 feet high.

The Ozark Trail continues on to nearby Johnson's Shut-Ins State Park, in Reynolds County where the East Fork of the Black River winds its way through rhyolite bedrock. The Black River eroded a channel down to the purplish volcanic rhyolite, creating a series of rock shoots and channels – called a shut-in – making it a dramatically beautiful, natural place to enjoy the water.

Read more about rhyolite and other igneous rocks at dnr.mo.gov/geology/geosrv/imac/indminerals.htm and dnr.mo.gov/geology/docs/gcsummer8.pdf. Learn more about Missouri State Parks at mostateparks.com.



Boil Water Order!

Boil water orders are issued by government or health officials when a community's drinking water supply is, or could be contaminated by pathogens such as *E.coli* or other microbial indicators of sewage contamination. Boil water orders also can be issued when the water system has a failure in distribution system integrity, indicated by a loss of system pressure. In this case, the loss of pressure does not necessarily mean water has been con-

taminated, but pathogens may have been able to enter the system due to a burst pipe or other system failure. The pathogens of most concern in the event of a boil water order typically cause gastrointestinal illnesses such as diarrhea, vomiting and cramps. To effectively kill these pathogens, the Centers for Disease Control recommends that consumers bring water to a rolling boil for at least one minute before it is safe for consumption. In elevations above 6,562 feet, it is recommended to boil water for 3 minutes to kill pathogens and make it safe for drinking. Boiled water should be used for drinking, brushing teeth and food preparation and cleanup. The Missouri Department of Natural Resources maintains a map and report of current boil water orders at dnr.mo.gov/env/wpp/boil. For questions regarding boil water orders, contact the department's Public Drinking Water Branch at 800-361-4827.



DNR photo by Andrew Richmond

... but not least

Missouri Geology Makes a Great Trout Stream

Limestone is important to fish and aquatic life

by Hylan Beydler

photograph by Scott Myers

Missouri's geology consists of an abundant amount of limestone. This sedimentary rock is predominantly composed of the calcium-bearing carbonate minerals calcite and dolomite, and is important to fish and aquatic life because it helps protect against rapid changes in pH.

As rainwater infiltrates into the ground and becomes groundwater, the limestone and slightly acidic water react. The groundwater is neutralized, while at the same time, small amounts of limestone are dissolved away. This process produces Missouri's karst landscape and is responsible for the large springs and some of the best trout habitat in the Midwest.

"I have enjoyed fly fishing for many years, and as a geologist, I study the characteristic of limestone chemistry; its ability to buffer acidic water has helped produce spectacular streams for trout, caught by myself and countless others who love to fish," said Larry "Boot" Pierce, Geologic Resources section chief with the Department of Natural Resources' Missouri Geological Survey.

In addition to the benefits of the mineral-rich, buffered water, the springs and spring-fed streams have a much more consistent year-round water temperature," Pierce said. This constant temperature allows for a steady growing cycle for vegetation and trout food sources such as macroinvertebrates and other smaller fish.

Some limestone consists almost entirely of skeletons of marine organisms and form very distinctive fossiliferous rocks. Other limestone consists of lime mud and has a very small grain size and a smooth texture. Deposited in warm, shallow seas, limestone is widely distributed across the earth. Limestone deposits often comprise the aquifers



The excellent trout fishing enjoyed by Missouri anglers is due, in no small part, to the beneficial qualities of limestone. Besides being the catalyst for creating natural springs, dissolved limestone improves water quality and supports aquatic food sources for trout.

from which we draw much of our drinking water.

Limestone is widely used as an industrial mineral and is sought for use in producing lime, pharmaceuticals and in glass-making. It has historically been used in construction, as many varieties make excellent building materials. The Missouri State Capitol is made from Missouri limestone. Numerous spectacular fossils are embedded in the building's walls, floors and stairways.

Read more about Missouri limestone, Missouri caves and

karst landscapes in *The Geologic Column of Missouri* online at dnr.mo.gov/geology/geolumn.htm; and the Capitol Fossils article in the Winter 2014 issue of *Missouri Resources*. It can be accessed online at dnr.mo.gov/magazine/documents/mr-winter14.pdf#page=4.

Hylan Beydler is division information officer for the Missouri Geological Survey, a division of the Missouri Department of Natural Resources.

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First Day Hikes!

Hikers throughout the country will be getting outdoors on Jan. 1, 2015, for America's State Parks First Day Hikes. Join Missouri State Parks for guided hikes at state parks and historic sites throughout the state. Begin 2015 with this great way to get outside, exercise, enjoy nature and welcome the New Year with friends and family.

To find a hike near you, visit mostateparks.com.

